Notice of Intent (NOI) No. DE-FOA-0003424

Issue Date: August 6th, 2024.

DISCLAIMER: The "Notice of Intent to Issue" is for informational purposes only; the Department of Energy is not requesting comments on the information in this notice.

This is a Notice of Intent to Issue Funding Opportunity Announcement No. DE-FOA-0003425 "Aligning Manufacturability & Pre-production Design (AMPD) for Storage Technologies"

The Department of Energy (DOE) Office of Electricity (OE) intends to issue a Funding Opportunity Announcement (FOA) seeking applications for financial assistance awards that would support the OE priorities of enabling a reliable, resilient, secure, and affordable electricity grid. The OE Energy Storage Division accelerates bi-directional electrical energy storage technologies as a key component of the future-ready grid. Addressing domestic pre-production manufacturability challenges that energy storage technology developers face when making design decisions that impact production of the technology, including scaling, will help expand the portfolio of technology options to meet customer needs.

BACKGROUND

OE provides national leadership to ensure that the Nation's energy delivery system is secure, resilient and reliable. Through research and development, OE develops new technologies to improve the infrastructure that effectively and securely brings electricity into our homes, offices, and factories.[1] OE's Energy Storage Division ensures that next generation energy storage technologies can serve as a resiliency asset that is cost effective, safe, and reliable. The OE Energy Storage Division supports applied materials development to identify safe, low-cost, and earth-abundant elements that enable cost-effective stationary storage.

Additionally, DOE is invested in advancing innovative energy storage technologies from early-stage R&D to widespread commercialization. The Energy Storage Grand Challenge (ESGC)[2] serves as the DOE-wide coordinating body for energy storage efforts. A goal of the ESGC is to develop and domestically manufacture energy storage technologies that can meet all marketplace demands by 2030.

An important element of energy storage technology development is establishing viable designs with the manufacturability of the technology in mind. This is similar to the engineering concept known as design for manufacturing (DFM) which is applied to increase production quality, increase production volumes, and/or decrease costs by designing parts to work well for the intended process.[3] DFM is a design method that was originally developed in the mid-1980s as

[1] https://www.energy.gov/oe/about-office-electricity
[2] https://www.energy.gov/energy-storage-grand-challenge/energy-storage-grand-challenge
[3] DOE Industrial Efficiency & Decarbonization Office (IEDO) Build4Scale – Training Modules Hub teaches

part of an integrated product development framework to improve industrial production sectors, but it has since been applied to other production sectors.[4]

Technology development and manufacturing stages are not linear, but iterative, as changes to the pre-production design to increase manufacturability of materials, subcomponents, components, and the overall technology system must be considered. These design changes can be in the form of strategies, techniques, or tools that improve manufacturability and reduce overall technology production cost. In this NOI, pre-production refers to energy storage technologies that have a Manufacturing Readiness Level (MRL) of 7 ("Capability to produce systems, subsystems, or components in a production representative environment") or lower.[5] MRL 7 indicates that "system detailed design activity is nearing completion" and that "[t]echnologies should be on a path to achieve [a Technology Readiness Level (TRL) of 7]".[6] Pre-production manufacturability challenges may relate to energy storage technology materials, subcomponents, components, or systems. Design solutions to improve manufacturability may impact a variety of metrics related to production costs, the levelized cost of storage (LCOS), commercial viability, synthesis and testing protocols (including safety considerations), equipment and material considerations, geographic or logistical constraints, and end-of-life considerations. Manufacturability of energy storage systems, components, and subcomponents would benefit significantly from early-stage design consideration.

Domestic industrial-scale stationary storage manufacturing capacity is an important aspect of overcoming the challenge of making domestic energy storage technologies cost competitive and overcoming barriers to widespread deployment. For example, for the last few years, manufacturers have been typically sold out of battery modules on a rolling six (6) to twelve (12) month basis, making availability of cells difficult and driving cost increases for the stationary storage market with smaller orders. [7] In another example, a recent DOE analysis indicated that 10-15 GW/year of manufacturing capacity will be needed by 2035 to support mature technology deployment at scale for long duration energy storage. [8] The same long duration energy storage analysis found that compressed air energy storage, liquid air energy storage, and lithium-ion batteries have high risk for manufacturing and assembly capacity, while some varieties of thermal energy storage and electrochemical batteries were found to have medium risk.

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manufacturing fundamentals to energy hardware innovators (https://www.energy.gov/sites/default/files/2021-07/Module_3D.pdf)

[4] Duarte PC Jr, Nakao F, Ortenzi A. Integrated product development and lifecycle management in building production – A case study for logistic of mortar distribution in building sites. Journal of Building Engineering. 2020 Nov;32:101802. doi: 10.1016/j.jobe.2020.101802. Epub 2020 Sep 14. PMCID: PMC7489327 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7489327/

[5] U.S. Department of Defense, "Manufacturing Readiness Level (MRL) Deskbook". 2011 https://www.dodmrl.com/MRL_Deskbook_V2.pdf

[6] Government Accountability Office, Technology Readiness Assessment Guide: Best Practices for Evaluating the Readiness of Technology for Use in Acquisition Programs and Project, 2016 https://www.gao.gov/assets/gao-16-410g.pdf

[7] Energy Storage Grand Challenge (ESGC) Cost Performance Report 2022 PNNL-33283, (https://www.pnnl.gov/sites/default/files/media/file/ESGC Cost Performance Report 2022 PNNL-33283.pdf)

[8] DOE, Pathways to Commercial Liftoff: Long Duration Energy Storage, March 2023 (https://liftoff.energy.gov/long-duration-energy-storage)

PLANNED FOA OBJECTIVE AND SCOPE

The objective of the planned AMPD FOA will be to facilitate innovative energy storage technology material, subcomponent, component, or system design to improve the pre-production manufacturability of one or more energy storage technologies. Identifying and implementing design innovations will align pre-production storage system design to set the stage for manufacturing scale up.

If this planned FOA is released, resulting awards will be made for projects that align with the scope below:

Applications to the AMPD FOA must propose design innovations as R&D solutions that address domestic pre-production manufacturability challenges and improve manufacturability against an estimated baseline. The design innovations must be solutions for specific, clearly identified manufacturability challenges, including, but not limited to, the selection, modification, or development of the size, shape, or composition of a material, subcomponent, component, or system. The design innovations must clearly and directly benefit one or more energy storage technologies that discharge energy in the form of electricity that supports stationary, non-mobility applications (including but not limited to, grid-scale or grid-connectable applications). The design innovation must improve manufacturability metrics and/or indicators (which may be technical or non-technical), such as the estimated production cost, time to produce, production volumes, supply chain issues, and product quality.

The design innovation, whether it targets a material, subcomponent, component, or system, should put one or more energy storage technologies on a path to advance from a TRL of at least 4 ("Component and/or system validation in laboratory environment") and an MRL of at least 4 ("Capability to produce the technology in a laboratory environment") to a TRL of at least 5 ("Laboratory scale, similar system validation in relevant environment") and an MRL of at least 5 ("Capability to produce prototype components in a production relevant environment").

Areas specifically not of interest include design innovations that seek to develop, modify, or provide support for the following topics and areas:

- Design innovations that do not focus on pre-production.
- Design innovations that improve only the performance or operational characteristics of energy storage technology materials, subcomponents, components, or systems without a clear direct improvement to manufacturability.
- Design innovations that improve the manufacturability of energy storage technologies for mobility applications or energy storage technologies that do not discharge energy in the form of electricity.
- Design innovations that improve the manufacturability of non-energy storage technologies including power electronics not essential to the function of the energy storage technology or other grid components.
- Manufacturing facilities or equipment for manufacturing of energy storage technologies.
- Projects that focus on manufacturing processes, approaches, or strategies, including 3-D printing or automation.

- Manufacturing workforce support or training programs.
- Manufacturing standards, regulations, or policies.
- Manufacturability improvements for flow battery membranes, system design, and manufacturing scale-up of flow battery production and cost-effective integration of flow battery systems. This is to avoid program overlap with DE-FOA-0003326: Platform Technologies for Transformative Battery Manufacturing, Subtopic 1.2 Processes and Design for Manufacturability of Flow Batteries, which closed on May 7, 2024 .

Applications that include topics from the above list will be deemed non-responsive and not be evaluated by DOE.

The project(s) funded by this opportunity will likely improve the manufacturability of an energy storage technology and advance the TRL and MRL of the technology. By advancing the TRL and MRL of an energy storage technology, project(s) funded by the AMPD FOA can contribute to reducing the levelized cost of storage and advancing short-, medium-, and long-duration energy storage technologies to meet customer needs. Results may benefit a consortium of developers if the design challenges are widely shared within an industry sector.

Improved manufacturability through design improvements generally results in reduced overall technology production costs for the improved energy storage technology. Manufacturability improvements have the potential to secure America's Clean Energy Supply Chain by encouraging deployment of storage technologies that meet cost feasibility and supply chain sustainability metrics. R&D projects that improve manufacturability of an energy storage material, subcomponent, component, or system may also contribute to the Long Duration Storage Shot Energy Earthshot to reduce storage costs by 90% in storage systems that deliver 10+ hours of duration by 2030 by expanding the portfolio of commercially-available and affordable technology options to serve long-duration applications.

GENERAL INFORMATION

DOE anticipates making the FOA available during Fall 2024. If the AMPD FOA is released, approximately $8M in Federal Funds, subject to annual congressional appropriation, is expected to be available for awarding new cooperative agreements. A cooperative agreement is distinguished from a grant in that it provides for substantial involvement of the Federal awarding agency in carrying out the project. While up to four (4) awards are anticipated for this FOA, the actual number of awards will depend on the applications submitted and the availability of funds. DOE anticipates making awards that have a single budget period and a period of performance that does not exceed three (3) years. DOE envisions that the awarded projects will consist of both research and development tasks. Award Recipients would be required to provide a minimum 20% non-federal cost share for R&D activities.

In the planned AMPD FOA, DOE expects to strongly encourage applicant teams to form partnerships of two or more entities, e.g., comprising a technology developer or producer of an energy storage material, subcomponent, component, or system, and a research institution with complementary knowledge and expertise. Applicants must be based in the United States and each participating organization/entity in an applicant team must be based in the United

States. Applicant teams will identify a lead organization/entity, with other team members identified as project partners.

DOE will not accept questions at this time regarding issuance of the planned FOA. Details on how to submit questions and comments will be provided in the FOA, if issued.

SUBMISSION AND REGISTRATION REQUIREMENTS FOR FULL APPLICATION

If the AMPD FOA is released, it will be posted at Grants.gov (http://www.grants.gov) and at FedConnect (http://www.fedconnect.net). Entities interested in applying for awards under the FOA are strongly encouraged to register at these sites to receive notification of announcements regarding the FOA. If DOE decides to issue the FOA, applications can only be submitted through Grants.gov.

There are several one-time actions an applicant must complete to submit a Full Application in Grants.gov (e.g., register with the System for Award Management (SAM), obtain a Unique Entity Identifier (UEI) number, register with Grants.gov, and register with FedConnect.net to submit questions). It is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to the AMPD FOA.

- **SAM** - Applicants must register with SAM at http://www.sam.gov/ prior to submitting an application in response to a FOA. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in SAM registration. Failure to register with SAM will prevent your organization from applying through Grants.gov. The applicant must maintain an active SAM registration with current information at all times during which it has an active Federal award or an application under consideration. More information about SAM registration for applicants is found at: https://www.fsd.gov/gsafsd_sp?id=gsafsd_kb_articles&sys_id=650d493e1bab7c105465eaccac4bcbcb.

  NOTE: If clicking the SAM links do not work, please copy and paste the URL into your browser.

- **UEI** - Applicants must obtain an UEI from the SAM to uniquely identify the entity. The UEI is available in the SAM entity registration record.

  NOTE: Subawardees/subrecipients at all tiers must also obtain an UEI from SAM and provide the UEI to the Prime Recipient before the subaward can be issued.

- **Grants.gov** - Applicants must register with Grants.gov and set up your WorkSpace. You cannot submit an application through Grants.gov unless registered. **Please read the registration requirements carefully and start the process immediately.**
  1) The Authorized Organizational Representative (AOR) must register at: https://apply07.grants.gov/apply/OrcRegister
  2) An email is sent to the E-Business (E-Biz) POC listed in SAM. The E-Biz POC

must approve the AOR registration using their MPIN from their SAM registration.

More information about the registration steps for Grants.gov is provided at: https://www.grants.gov/web/grants/applicants/registration.html

In addition:

- *Add a Profile to a Grants.gov Account*: A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log in to one Grants.gov account to access all of your grant applications. To add an organizational profile to your Grants.gov account, enter the UEI for the organization in the UEI field while adding a profile. For more detailed instructions about creating a profile on Grants.gov, refer to: https://www.grants.gov/web/grants/applicants/registration/add-profile.html

- *EBiz POC Authorized Profile Roles*: After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant's request for Grants.gov roles and access is sent to the EBiz POC. The EBiz POC will then log into Grants.gov and authorize the appropriate roles, which may include the AOR role, thereby giving you permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role.

  NOTE: When applications are submitted through Grants.gov, the name of the organization applicant with the AOR role that submitted the application is inserted into the signature line of the application, serving as the electronic signature. The EBiz POC **must** authorize people who are able to make legally binding commitments on behalf of the organization as a user with the AOR role; **this step is often missed and it is crucial for valid and timely submissions.**

  For more detailed instructions about creating a profile on Grants.gov, refer to: https://www.grants.gov/web/grants/applicants/registration/authorize-roles.html

  To track your role request, refer to: https://www.grants.gov/web/grants/applicants/registration/track-role-status.html

  Questions relating to the **registration process, system requirements, or how an application form works** must be directed to Grants.gov at 1-800-

518-4726 or support@grants.gov.

- **FedConnect.net -** Applicants must register with FedConnect to submit questions. FedConnect website: www.fedconnect.net.

DISCLAIMER

This NOI is issued so that interested parties are aware that DOE may issue a FOA on this topic. Any information contained in this NOI is subject to change.

No Concept Papers or Full Applications are being requested or will be accepted in response to this NOI.